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DYNAMIC TESTS ON WOOD-NAIL JOINTS.(U)
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DYNAMIC TESTS

ON

FOOD - NAIL BENTS.

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DYNAMIC TESTS ON
WOOD-NAIL JOINTS

✓ A JOINT TESTING PROGRAM CONDUCTED BY
THE MILITARY TRAFFIC MANAGEMENT COMMAND
AND US ARMY MATERIAL DEVELOPMENT AND
READINESS COMMAND.

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* * ABSTRACT * *

Approximately 250 dynamic tests have been performed on eight types of wood-nailed joints. Due to the delay in delivery of high carbon nails, a complete set of tests could not be completed until April 1975. This interim report presents the results for one type of wood-nail joint.

ABSTRACT for	
HTS	White Section <input checked="" type="checkbox"/>
HUC	Buff Section <input type="checkbox"/>
DIAGRAMS	<input type="checkbox"/>
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DYNAMIC TESTS ON WOOD-NAIL JOINTS

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PART I
BACKGROUND INFORMATION

Descriptions of laboratory procedures, equipment, and test material were included in a report titled, "Transportability Criteria for Cargo Restraints", dated July 1974. Included in the report is information describing the reason for the joint project.

The present test plan specifies testing of eight wood-nailed joints. Some laboratory tests have been performed on all eight specimens. However, only test specimen 1 has been completed because the high carbon coated nails were difficult to procure.

This report describes the procedures that are used to present the test results. Basically, it describes the procedures used after the laboratory test data are stored on the magnetic tapes.

PART II DATA REDUCTION

A. EQUIPMENT:

Raw data stored on magnetic tapes were used to obtain digital data for evaluating the strength of the wood joints. A skematic, Figure 1, can help describe the process.

1. TAPE RECORDER:

The magnetic tape containing the raw data is read by this tape recorder.

2. A/D CONVERTER:

Before the raw data can be used in the computer it must be converted from Analog to Digital format. In the Analog format the data are continuous and therefore form a curve. To convert to Digital form, the curve is read at specific intervals starting from a designated location. The designated location is obtained by having the computer analyze the readings for Channel 1. The data for Channel 1 are compared until 10 readings having progressing values are found. Then it returns to the first of the ten readings and takes the prior 30 readings and uses those for computing the time zero value or baseline reading. Since electrical noise can cause some readings to be high and can distort the baseline reading, the computer will determine the standard deviation and will disregard any value that is greater than 2 Sigma in the recalculation of the zero value. In addition to the statistical procedure for reducing the effect of noise, a filter is used on Channel 1. Details for this filter are shown in Figure 2. The effect of the filter can be seen by comparing Figures 3 and 4.

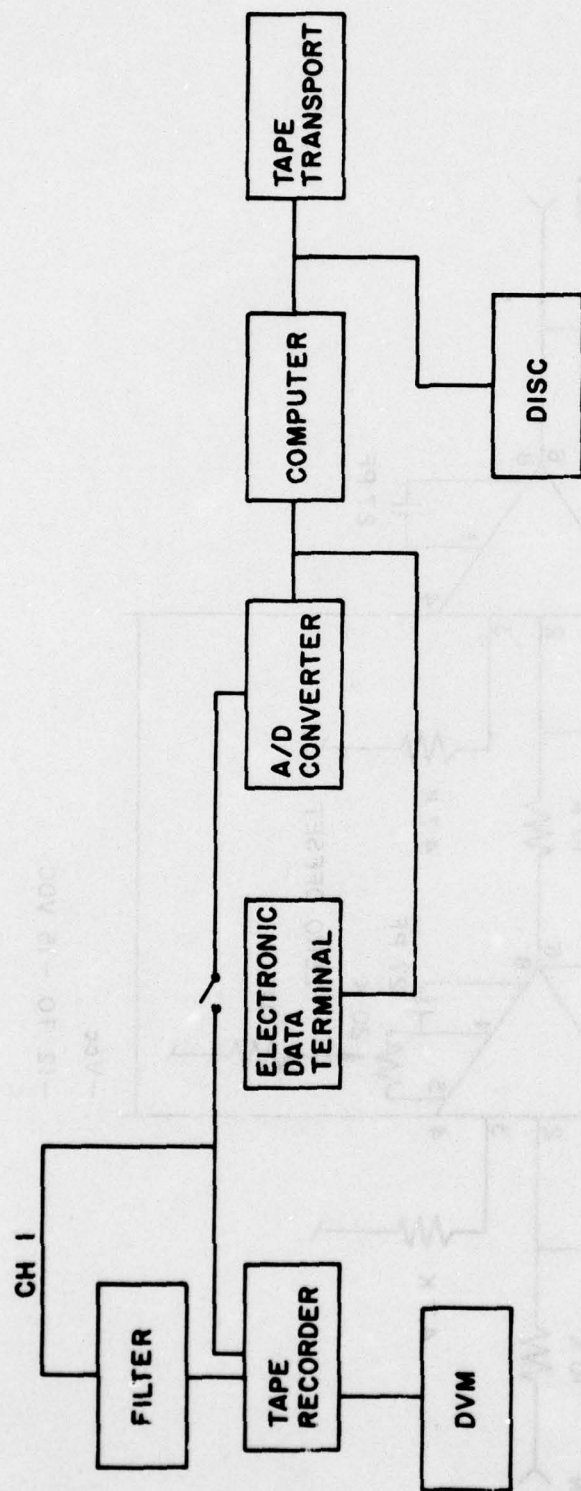


FIGURE 1. DATA REDUCTION PROCESS

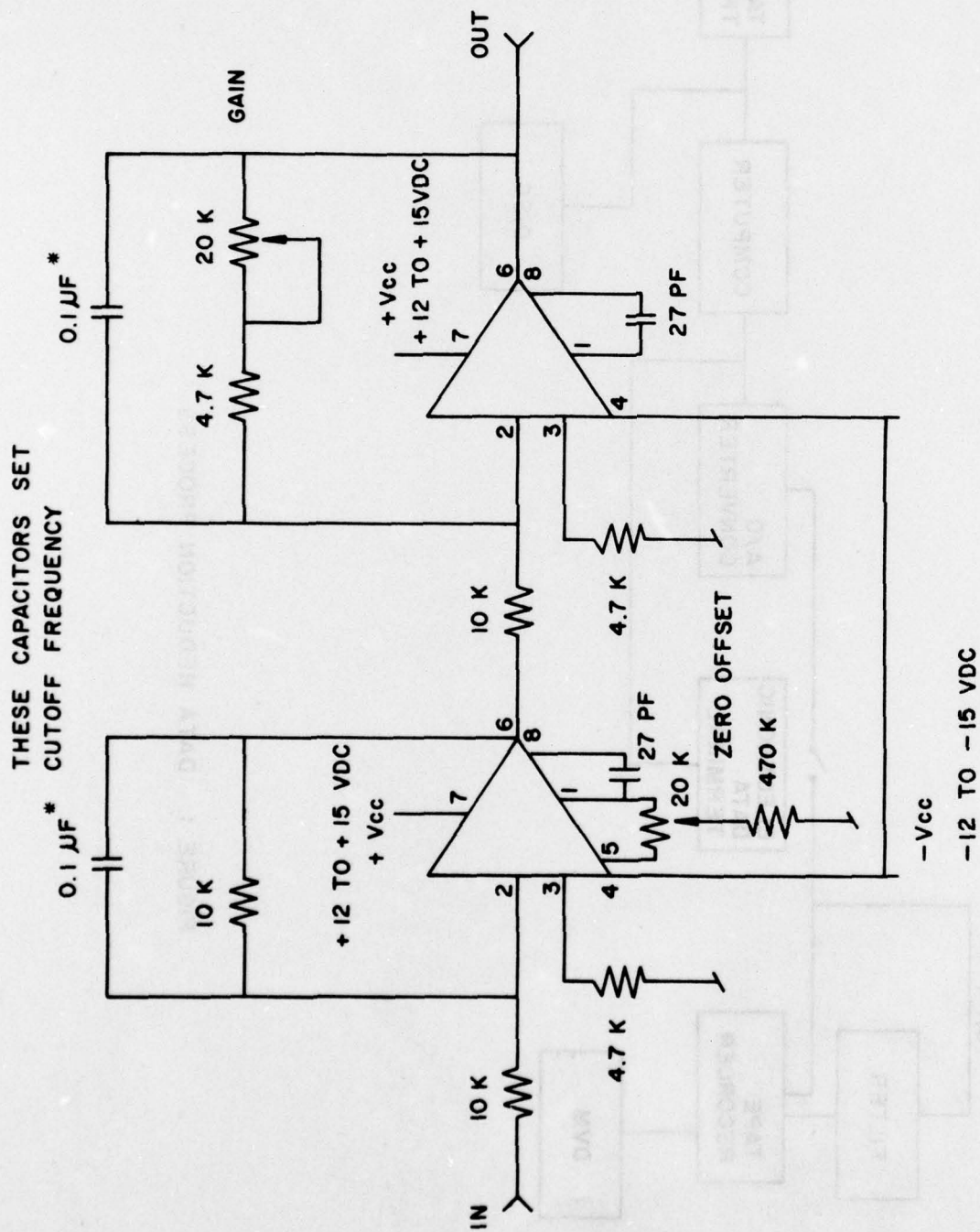


FIGURE 2. OPERATIONAL AMPLIFIER LM 301 OR EQUIVALENT

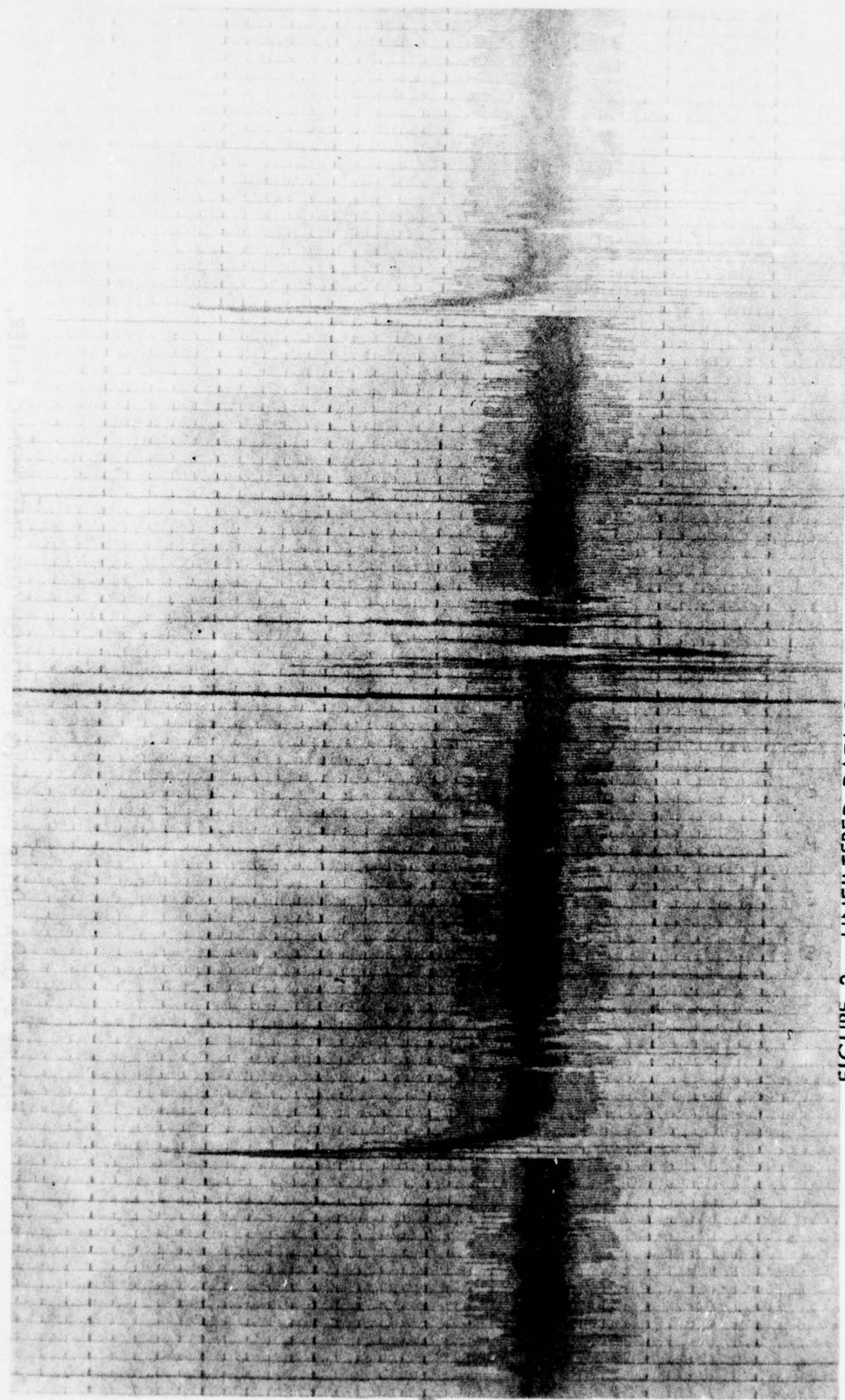


FIGURE 3. UNFILTERED DATA ON CHANNEL 1

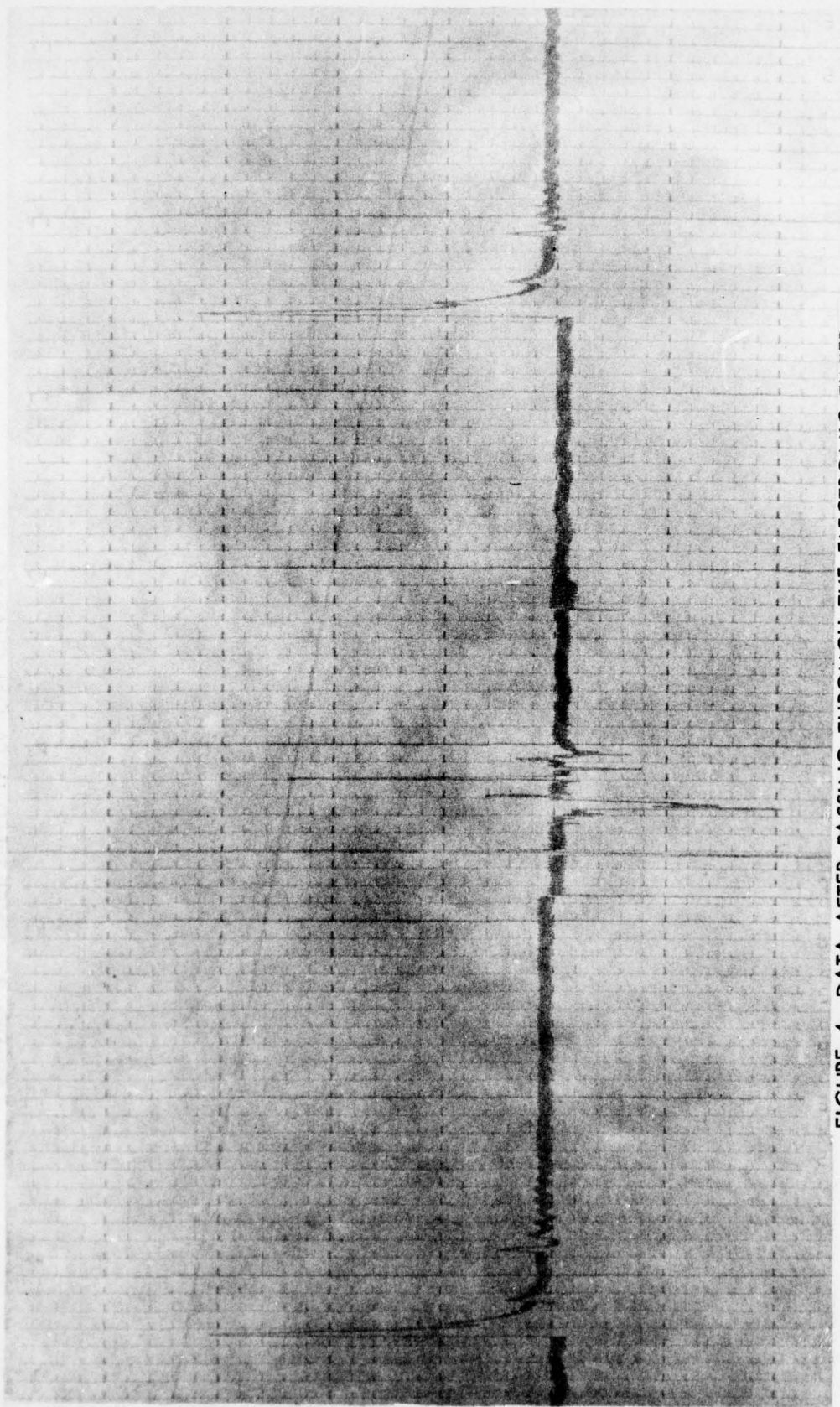


FIGURE 4. DATA AFTER PASSING THROUGH THE ELECTRONIC FILTER.

3. ELECTRONIC DATA TERMINAL:

This is the device used to input instructions and data to the computer, and it is also used to provide a hard copy of selected output from the computer.

4. COMPUTER:

All computations and repetitive type operations are performed by this electronic brain.

5. DISC AND TAPE TRANSPORT:

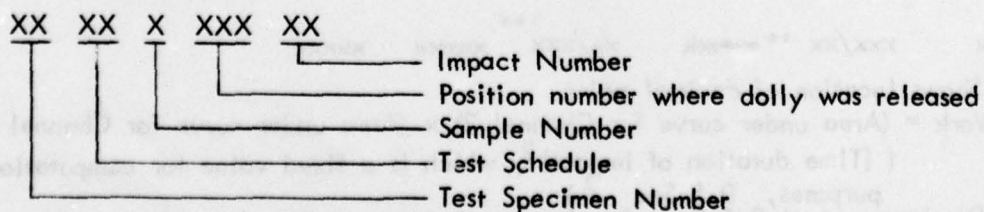
Output from the computer is stored on a computer disc and also on magnetic tape.

B. PROCEDURE:

1. The magnetic tape containing raw data from the laboratory tests is placed on the tape recorder. Using earphones to hear the calibration information for each of the six channels, the tape recorder channels are adjusted to yield voltage readings comparable to those recorded in the instrumentation van. This procedure will reduce the error in using two tape recorders to record and play back the information.

2. By placing a magnetic tape on the tape transport the computer system is ready for operation. After calling up the program from the computer file, the computer will instruct the operator to enter the ten digit test run number.

The run number is described as follows:



When the computer receives the tenth digit number it will print "is number right?" and "is Analog tape ready?" If the answers are yes, activation of the return key will advance the computer to the next step. If the answers are no, then a "NN" reply will instruct the computer to request the test run number again. A copy of the program is presented as Appendix 1. After the computer receives the correct number and the two questions are answered, the computer will wait for the data from the magnetic tape. The data are entered by the operator starting the tape recorder, and while listening to the audible countdown for the impact, a switch is activated between the audible count of two and one. The switch allows the data to be processed through the Analog/Digital (A/D) converter to the computer. Only one-half second of data is analyzed after the computer establishes zero time. A summary of the data is printed on paper in the electronic data terminal. An explanation of the information included in the summary is presented below.

Channel	Channel	Channel	Channel	Channel	Channel	
1	2	3	4	5	6	
xxxxx0/	xxxxx0/	xxx/xx	xxx/xx	xxx/xx	xx/xxx	Zero reference
xxxxx0/	xxxxx0/	xxx/xx	xxx/xx	xxx/xx	xx/xxx	Maximum value
xxxxx0/	xxxxx0/	xxx/xx	xxx/xx	xxx/xx	xx/xxx	Minimum value
xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	Remainder
xxxxx/	xxxxx/	xx/xxx	xx/xxx	xx/xxx	xx/xxxx	Area under curve
xxxxx	xxx/xx	xxxxx	xx/xxx	xxxxx	xxxxx	

* / Shows location of decimal point.

** Work = (Area under curve for Channel 2) x (Area under curve for Channel 6) ÷
 ([Time duration of impact]², which is a fixed value for computational
 purposes, 0.5 Sec²)

*** Displacement at 0.5 Sec after impact (Permanent displacement)

The Digital data and summary are stored on the disc and magnetic tape.

Each impact requires the operator to repeat the above procedure from the step of calling up the program.

3. Since each test may have approximately thirty impacts, another computer program is used to obtain data for plotting a curve that will best represent the data results for two variables. The program shown as Appendix 2 utilizes the least squares method and the Gauss elimination process of solving simultaneous equations.

4. When the program is used, the first information that must be supplied to the computer through the electronic data terminal is the degree of polynomial the user desires the equation to be. The maximum degree is 10. As a general rule, the higher the degree of the polynomial the more the best-fit curve will respond to deflections in the data. After the computer receives the two digit number it will request the x and y values of the data points. The values must be in the following form:

xx.xxxy.yy

At the conclusion of the data input, the operator must input "00.0000.00" to have the computer process the data. Output from the computer will give coefficients for each power of the equation. Then it will request the operator to enter x values for plotting the best-fit curve. When the value is entered and the return key is depressed, the computer will calculate the corresponding y value and have the x and y values printed on the paper in the data terminal. The computer will accept x values until 00.00 is entered. Because zeroes are used to signal the computer that the input is completed, all input values must

be greater than zero.

C. RESULTS:

Summaries from the computer output for the impacts are numerous and are considered uneconomical to publish. The summaries were analyzed and condensed to show the yield and maximum forces that the various samples withstood. These results are shown in Appendix 3. The data for the dolly impact force; dolly, hammer, and specimen accelerations; permanent displacements; and total displacement are obtained from the impacts that provide the yield and maximum forces on the hammer.

PART III
DATA EVALUATION

A. DATA EVALUATION:

1. Data evaluation will be discussed by describing the parameters used in the tables, and by giving other details that may be of interest.

2. Refer to the column headings in Appendix 3.

B. TEST NUMBER: (Column 1) . This number represents the test specimen number and the test schedule number. For example, 1-6 means that the data is for Test Specimen 1, Test Schedule 6 (See Appendix 4). Information provided under this number provides a brief description of the test specimen. The phrase "Oak on WH" means that the blocking or test specimen material is oak and the floor material is Western Hemlock. The nails are described by a phrase similar to "50d HCB" which represents a 50 penny high carbon nail with a bright finish.

C. RUN NUMBER: (Column 2). The sequential order in which the samples were tested.

D. MOISTURE CONTENT: (Column 3). Readings obtained by using the moisture detector.

E. DOLLY WEIGHT: (Column 5). The weight of the dolly including the hammer weight. Without including the weight of the hammer, the dolly weighs 1514 pounds.

F. DOLLY IMPACT FORCE: (Column 6). For this column and the remaining columns, except the hammer weight in Appendix 3, there are two lines of data for each run number. The first line contains data based on the impact

that produces the yield point described under "Hammer Impact Force". The second line is based on the impact that produces the maximum value for the hammer impact force. On the computer printout, the dolly impact force is located in the first column and second row of each impact. A zero must be added to obtain the actual value. The dolly force shown on the first line of each run in the referenced appendix is obtained from the last impact in the yield point range, refer to Listing 1 Test Run Number 0106106120.

G. DOLLY ACCELERATION: (Column 7). Dolly vibrations are measured by a mechanical transducer with an electrical output. At low frequencies relative to the natural frequency of the transducer, the transducer acts as an accelerometer. Primarily, because of this characteristic and because the frequencies of the components are difficult to measure, the acceleration data should not be given a high degree of importance. The dolly acceleration is located in fourth column and the second row of each computer printed data summary. See last sentence in "Dolly Impact Force" for selection of value used in the appendix.

H. HAMMER WEIGHT: "Hammer" is the nomenclature for the load cell transducer assembly and the control weights. The hammer weight is changed by adding or removing metal slabs to provide sufficient number of impacts to locate a yield point and maximum force the specimen will sustain.

I. HAMMER IMPACT FORCE:

1. This is the most important value in the data listing. It is the peak value of the dynamic force input into the test specimen. On the computer printed output it is the value in the second column and second row.

A zero must be added to obtain the actual value. The value of the hammer impact force shown in the first line of each run in Appendix 3 is an arithmetic average value of several impacts in the yield point range. This value is the yield point for the specimen. "Yield Point" as used in this report is determined somewhat different than the procedure used to locate the point in materials like metals -- that is, to plot a stress-strain curve. Before explaining the procedure, a description of the yield point will be given. Consider the curves shown on Figure 5. The scale on the left is used to read the two upper curves; however, the bottom curve must use the scale on the right. The calibration curve is not used to determine the yield point but is included to show the force that would result if the specimen was a solid mass, that is, a single piece of lumber instead of a nailed joint. Observe the lower curve which is a plot of the permanent displacement versus the distance up the ramp on the conbur type incline ramp. There are two locations where the curve could be considered flat. The second flat portion is considered to be the location of the yield point. Since the force on the cleat or hammer impact force fluctuates within that corresponding flat range, the force is arithmetically averaged for several impacts.

2. The procedure for calculating the yield point can be explained by using a sample of the computer printout, Listing 1. Observe the number in the fourth column and sixth row which is the permanent displacement. Starting at test run number 0106105116, the number is -00127. The negative sign means that the wire length in the displacement transducer is decreasing, which is

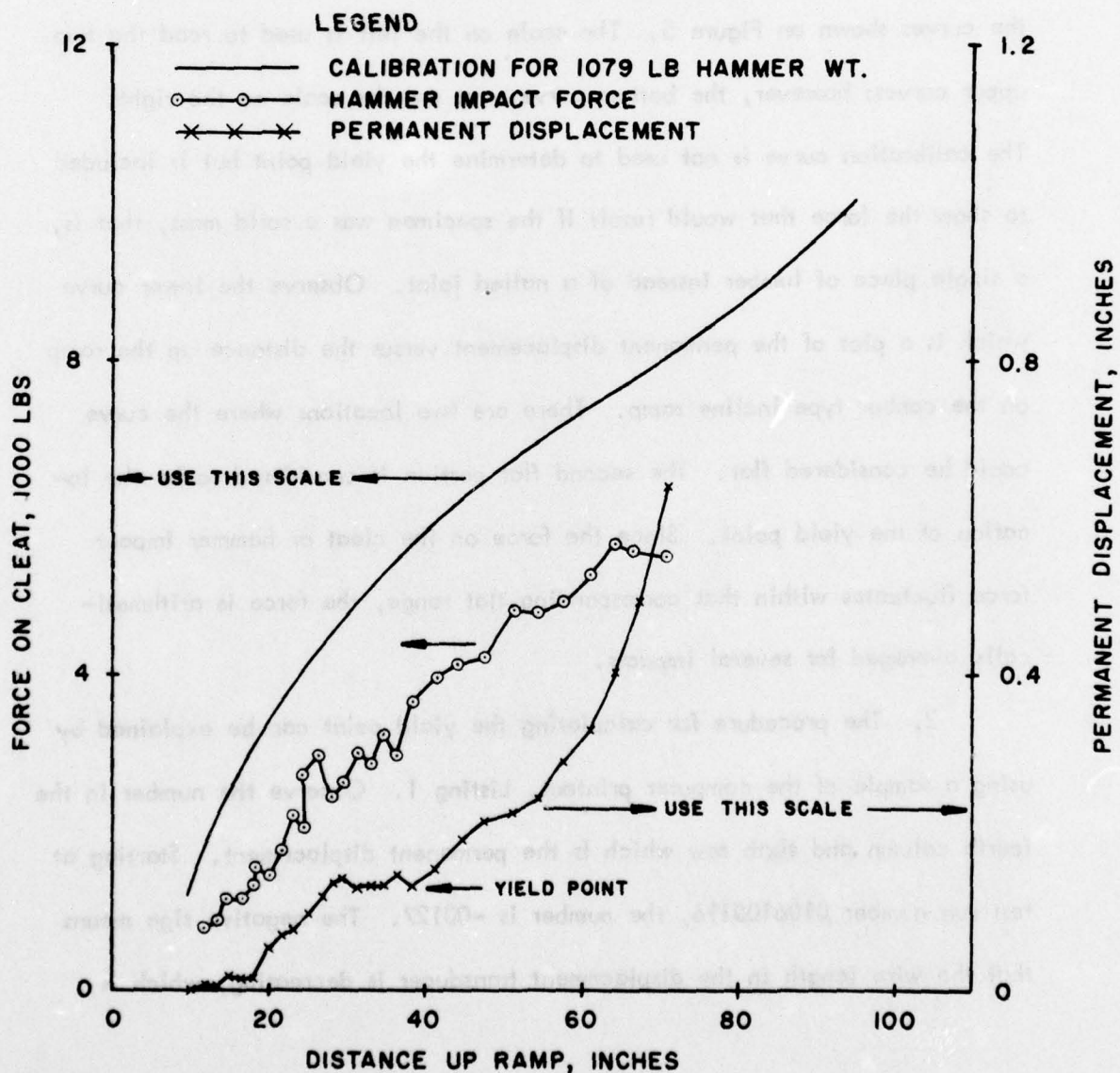


FIGURE 5. TEST RESULTS FROM TEST I-6, RUN I

DP? BIDT 0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106102

5116

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00002	+00025	-00012	-00009	-00018	-00126
+00386	+00285	+00378	+00441	+00296	+00126
+00000	-00025	-00116	-00081	-00078	-00136
+00383	+00018	+00116	+00127	+00304	-00764
+00449	+00104	+00208	+00191	+00212	-00132
+00000	+03432	-00002	-00129	-00038	-00126 !

DP? BIDT 0030

DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106105217

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00002	+00023	-00010	-00011	-00012	-00125
+00380	+00303	+00360	+00457	+00318	+00125
-00014	-00025	-00116	-00079	-00050	-00155
+00163	+00553	+00729	+00203	+00276	-00689
+00449	+00109	+00207	+00199	+00188	-00177
-00001	+04823	-00006	-00131	-00002	-00124 !

DP? BIDT 0030

DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106105318

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00002	+00010	-00014	-00016	-00020	-00127
+00398	+00332	+00462	+00406	+00342	+00127
-00008	-00016	-00064	-00072	-00044	-00177
+00012	+00579	+00498	+00379	+00004	-00760
+00456	+00177	+00234	+00237	+00232	-00210
-00002	+09292	-00008	-00136	-00002	-00126 !

DP? BIDT 0030

DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106105419

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00001	+00030	-00009	-00015	-00017	-00142
+00427	+00312	+00329	+00401	+00339	+00142
-00009	-00030	-00095	-00055	-00113	-00164
+00829	+00691	+00100	+00250	+00489	-00414
+00457	+00093	+00210	+00240	+00217	-00162
-00002	+03766	+00000	-00146	-00008	-00146 !

DP? BIDT 0030

DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106106120

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00002 +00020 -00014 -00014 -00018 -00146

+00436 +00346 +00408 +00420 +00360 +00146

-00020 -00020 -00184 -00058 -00096 -00184

+00479 +00634 +00558 +00691 +00637 -00542

+00477 +00142 +00234 +00233 +00231 -00186

+00000 +06603 -00006 -00143 +00002 -00136 !

OP? BIDT 0030

DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

01061062

IS NUMBER RIGHT?NN

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106106321

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00004 +00004 -00017 -00020 -00025 -00144

+00462 +00388 +00409 +00702 +00403 +00144

-00026 -00006 -00117 -00046 -00065 -00214

+00095 +00297 +00111 +00087 +00124 -00097

+00505 +00231 +00263 +00281 +00282 -00251

-00001 +14495 -00002 -00161 -00022 -00140 !

OP? BIDT 0030

DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106107122

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00003 +00026 -00012 -00005 -00020 -00174

+00513 +00400 +00414 +00671 +00402 +00174

-00017 -00026 -00254 -00081 -00140 -00202

+00511 +00063 +00020 +00434 +00219 -00317

+00523 +00149 +00260 +00212 +00257 -00191

-00003 +07114 -00002 -00194 -00022 -00170 !

OP? BIDT 0030

DEBUG TERMINATED

ENTER TEST RUN NUMBER

XXXXXXXXXX

0106107323

IS NUMBER RIGHT?

IS ANALOG TAPE READY?

-00001 +00021 -00010 -00008 -00018 -00177

+00511 +00421 +00476 +00538 +00416 +00177

-00013 -00023 -00124 -00128 -00084 -00237

+00096 +00759 +00380 +00331 +00145 -00050

+00518 +00167 +00260 +00233 +00255 -00260

+00000 +10855 -00002 -00215 -00024 -00186

correct for the direction the transducer is mounted. The decimal point is located three digits from right. Therefore, the permanent displacement is 0.127 inch. Continue to observe the number in the same location for each succeeding impacts. The numbers are 0.127, 0.133, 0.136, 0.145, 0.133, 0.153, 0.190, and 0.215. By comparing the values you can see that the first five values do not have a large difference nor do they continue to increase. This indicates that the yield point includes the impacts prior to and including impact 20 or test run number 0106106120. To determine the number of impacts to include in the averaging of the hammer impact force, the force values (second column, second row) must also be observed. If these values do not vary much or if the difference between the highest value and lowest value are within 80 (800 lbs) then the numbers can be averaged. If the range is more than 80, reduce the lowest number impact until the range is acceptable. The "80" value is an arbitrarily selected number. The last impact in the range, 0106106120, is used to obtain the information for the other variables that are recorded on Line 1 in Appendix 3.

3. To verify the procedure for determining the yield point, a special test was performed (Test 1-34). Components for the joint were same as those for Test 1-30. Instead of increasing the force on the specimen until failure occurred, the dolly release point was increased until it reached the position corresponding to the beginning of the yield point range of Test 1-30. At that position, the dolly was released twenty times. To complete the test, the dolly release point was increased until failure occurred.

4. Results of that test are shown in Figure 6. Note that the twenty

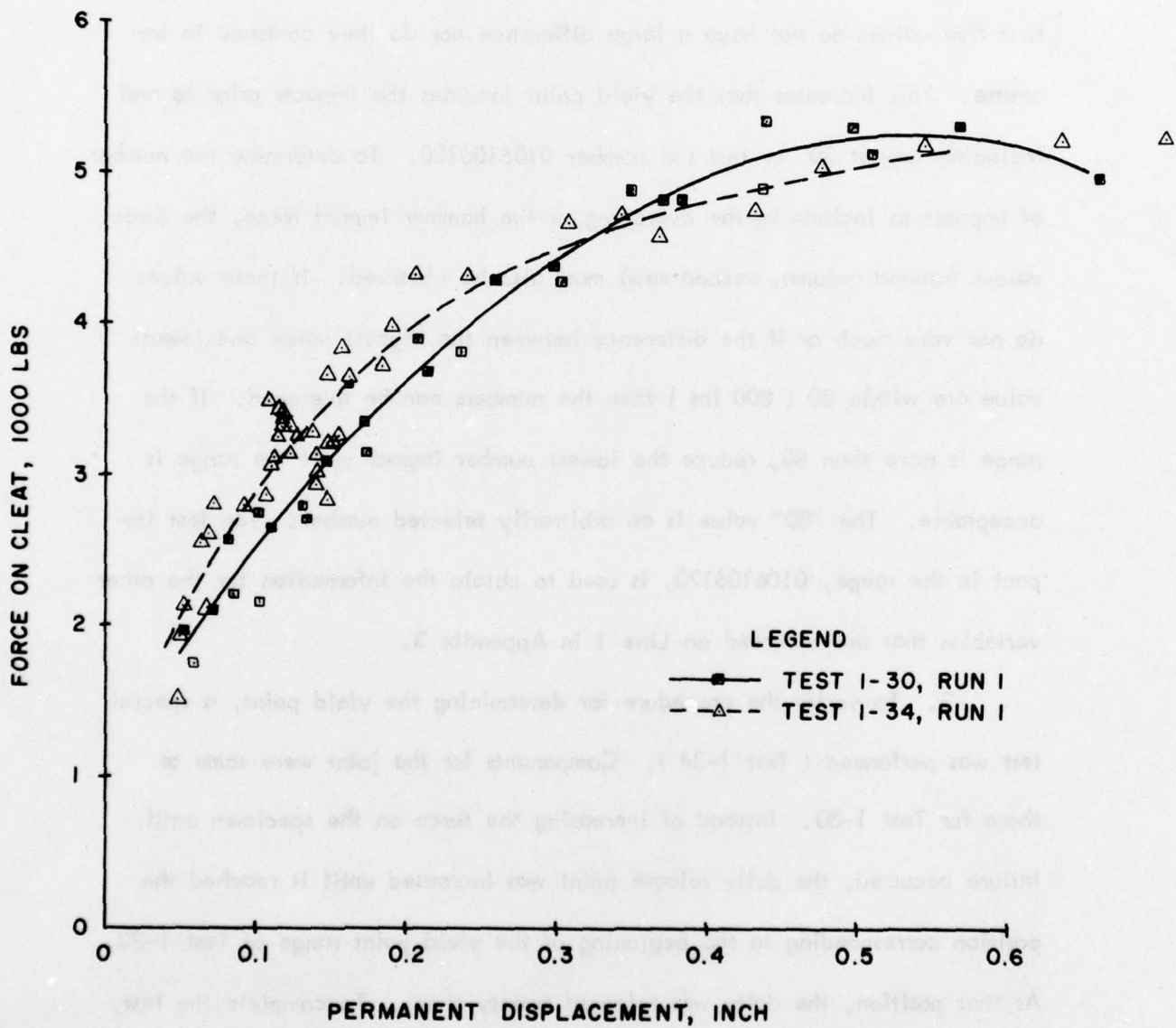


FIGURE 6. VERIFICATION OF YIELD POINT

extra impacts did not adversely affect the shape of the curve. Based on these results it is concluded that the procedure for determining the yield point is acceptable.

5. The second line for each run in Appendix 3 is for the maximum force the specimen withstood. Again the dolly force, dolly acceleration, permanent displacement, etc. correspond to the impact that gives the maximum force on the specimen.

6. The data in Appendix 3 were obtained from the computer printout without using the computer to determine a best-fit curve to represent the data. It was concluded that application of the best-fit curve was too time consuming for the benefit that it would give.

J. HAMMER ACCELERATION:

The hammer acceleration for each impact is found in the computer printout at the fifth column and second row. The decimal point is located two digits from the right.

K. SPECIMEN ACCELERATION:

Care must be exercised in using the computer printout to locate the number for the specimen acceleration. The accelerometer is mounted on the specimen in a direction that is 180 degrees from the direction the other accelerometers are mounted. Some of the personnel that operated the instrumentation van would change the polarity of the data signals from the transducer; therefore, the acceleration signals would be positive. The location on the computer printout would then be Column 3 and Row 2. However,

if the polarity were not changed, the location would be Column 3 and

Row 3. The decimal point is located two digits from the right.

L. PERMANENT DISPLACEMENT:

As mentioned earlier, the permanent displacement was recorded on the computer printout at location, Column 4 and Row 6. Decimal point is located three digits from right. This value represents the displacement of the cleat at 0.5 second after impact.

M. TOTAL DISPLACEMENT:

Total displacement is the sum of the permanent displacement and the displacement caused by the dynamic force. It is obtained by adding the values from Column 6, Rows two and three. Decimal point is located three digits from right.

PART IV DISCUSSION

A. In the discussion and use of the test results, there is one important factor that must be considered. Each test was performed only three times, and the lumber for those three runs may have come from the same board. This will prevent the use of statistical analysis in determining a degree of confidence for the data. However, the data does present some interesting results.

B. Observe the data in Table 1. The strength of the joints can be combined into four groups. The first group would consist of Oak on Oak using 50d high carbon, coated nails. The next eleven joints would be Group II. Group III would consist of the next eight joints. Again, only one joint would constitute a group - Group IV. Because the maximum strength for an oak on oak joint using 50d low carbon coated nails is high, it may belong in Group II instead of Group III.

C. To show the effect of changing the materials in the joint, consider Table 2. The first two groupings shows the effect of specific gravity on the strength of the joint. Comparing the average yield and maximum strengths show that a change in the specific gravity of the blocking material produces a negligible effect on the joint strength. However, a change in the specific gravity of the floor material produces a corresponding change in the strength of the joint. In considering the results from Test 1-1 and 1-25, no explanation can be given for the small difference between the two values considering the other tests in that group do show significant differences.

D. The next four groupings show the effect of nail size. Even though

TABLE I. Test Results. Yield and Maximum Strengths in Order of Decreasing Yield Strengths.

Blocking Material	Floor Material	Average Yield Strength, *Lb	Average Maximum Strength, *Lb	Nail Size	Nail Material	Nail Finish	Test Number	Group
Oak	Oak	1741	3113	50d	1040T	Coated	1-31	I
Oak	S. Pine	1293	1574	50d	1040T	Bright	1-25	II
Oak	Oak	1290	2055	50d	L. Carbon	Bright	1-15	
Oak	Oak	1279	1646	50d	1040T	Bright	1-1	
Oak	Oak	1272	1969	40d	1040T	Coated	1-17	
Engleman Spruce	Oak	1237	1742	50d	1040T	Bright	1-12	
S. Pine	Oak	1209	1577	50d	1040T	Bright	1-14	
W. Hemlock	Oak	1192	1806	50d	1040T	Bright	1-11	
Oak	S. Pine	1118	1691	50d	1040T	Coated	1-26	
Engleman Spruce	Oak	1115	1699	50d	1040T	Bright	1-13	
W. Hemlock	Oak	1113	1695	50d	1040T	Bright	1-10	
Douglas Fir	Oak	1058	1760	50d	1040T	Bright	1-8	III
Oak	Douglas Fir	1049	1426	50d	1040T	Bright	1-4/ 1-23	
Oak	W. Hemlock	1038	1450	50d	1040T	Coated	1-28	
Oak	Douglas Fir	1024	1464	50d	1040T	Coated	1-24	
Oak	Oak	938	1778	50d	L. Carbon	Coated	1-16	
Oak	Oak	931	1212	40d	1040T	Bright	1-18	
Oak	Oak	836	1508	40d	L. Carbon	Coated	1-19	
Oak	Oak	834	1342	40d	L. Carbon	Bright	1-20	
Oak	E. Spruce	804	1414	50d	1040T	Coated	1-30	
Oak	W. Hemlock	777	1435	50d	1040T	Bright	1-6/ 1-27	
Oak	Engleman	687	1119	50d	1040T	Bright	1-7/ 1-29	IV

* Based on 3 samples. Force per nail.

some of the results do not show an appreciable difference, it can be concluded that nail size affects the results. However, the data do not indicate if the nail diameter or depth of penetration contributes the major portion of the effect. This is because the nail diameter and length increase with nail size and it would be difficult to determine the effect of either parameter without manufacturing special nails.

E. The next seven pairs in the table show the effect of nail coating. With the exception of oak on oak, the coating did not appreciably affect the strength. To reduce the possibility of time affecting the strength of coated nails, most of the joints were tested within one hour after they were nailed.

F. The only comment on the last two pairs in Table 2 is that no explanation can be furnished until additional data are analyzed from other specimens.

The data have not been corrected for moisture contents above or below 12%.

G. By just comparing yield and maximum strengths without knowledge of the strength curve could cause a user of the data to overlook features that could otherwise be used. The curves in Figure 7 show how specific gravity affects the slope of the curve. A joint made of high specific gravity lumber like oak (for example Test 1-1) will have a steep slope. The yield point is located near the relative sharp break in the curve. This means that the joint will not withstand much additional force before the maximum force is obtained. However, a joint constructed of oak nailed onto Western Hemlock (for example Test 1-6) the yield point is almost one-half the maximum strength. Therefore, a designer may be able to use the oak/Western Hemlock joint without a safety

TABLE 2. Test Results. Comparisons of Joint Materials.

Test Number	Variable	Yield Strength, Lb/Nail				Max Strength, Lb/Nail			
		1	2	3	AV	1	2	3	AV
1-1	Sp. G _B /Sp. G _F * 0.63/0.63	1355	1357	1124	1279	1788	1600	1550	1646
1-25	0.63/0.55	1178	1455	1245	1293	1663	1600	1460	1574
1-23	0.63/0.50	1154	1053	940	1049	1410	1583	1285	1426
1-6	0.63/0.45	785	881	666	777	1415	1503	1388	1435
1-7	0.63/0.35	683	646	731	687	1140	1030	1188	1119
1-14	0.55/0.63	1232	1131	1264	1209	1598	1538	1595	1577
1-8	0.50/0.63	884	1274	1015	1058	1738	1898	1645	1760
1-9	0.50/0.63	1035	1071	1051	1052	1395	1410	1398	1401
1-10	0.45/0.63	1087	1094	1158	1113	1718	1718	1650	1695
1-11	0.45/0.63	1168	1183	1224	1192	1730	1858	1830	1806
1-12	0.35/0.63	1275	1095	1340	1237	1930	1515	1780	1742
1-13	0.35/0.63	1097	1150	1099	1115	1570	1780	1748	1699
1-16 1-19	50 LCC	767	1064	983	938	1540	1835	1958	1778
1-19	40 LCC	652	878	978	836	1555	1473	1498	1509
1-22	30 LCC	622	651	729	667	838	913	965	905
1-15	50 LCB	1228	1506	1136	1290	2238	2048	1880	2055
1-20	40 LCB	845	813	844	834	1430	1218	1378	1342
1-32	30 LCB	730	-	623	677	1308	1268	1553	1376
1-31	50 HCC	1714	1802	1708	1741	2503	3484	3353	3113
1-17	40 HCC	1169	1422	1224	1272	2030	1928	1950	1969

Test Number	Variable	Yield Strength, Lb/Nail				Max Strength, Lb/Nail			
		1	2	3	AV	1	2	3	AV
1-21	30 HCC	1458	1390	1208	1352	1930	1980	2010	1973
1-1	50 HCB	1355	1357	1124	1279	1788	1600	1550	1646
1-18	40 HCB	974	827	1069 853	931	1305	1115	1315 1113	1212
1-33	30 HCB	1084	1111	1103	1099	1460	1543	1505	1503
1-1	50 HCB Oak/Oak	1355	1357	1124	1279	1788	1600	1550	1646
1-31	50 HCC Oak/Oak	1714	1802	1708	1741	2503	3484	3353	3113
1-25	50 HCB Oak/S.P.	1178	1455	1245	1293	1663	1600	1460	1574
1-26	50 HCC Oak/S.P.	983	1239	1131	1118	1720	1695	1658	1691
1-23	50 HCB Oak/D.F.	1154	1053	940	1049	1410	1583	1285	1426
1-24	50 HCC Oak/D.F.	1071	911	1090	1024	1525	1488	1378	1464
1-6 or 1-27	50 HCB Oak/W.H.	785	881	666	777	1415	1503	1388	1435
1-28	50 HCC Oak/W.H.	1001	990	1124	1038	1420	1400	1530	1450
1-7 or	50 HCB Oak/E.S.	683	646	731	687	1140	1030	1188	1119
1-30	50 HCC Oak/E.S.	824	971	618	804	1338	1423	1480	1414
1-18	40 HCB Oak/Oak	974	827	1069 853	931	1305	1115	1315 1113	1212
1-17	40 HCC Oak/Oak	1169	1422	1224	1272	2030	1928	1950	1969
1-20	40 LCB Oak/Oak	845	813	844	834	1430	1218	1378	1342

Test Number	Variable	Yield Strength, Lb/Nail				Max Strength, Lb/Nail			
		1	2	3	AV	1	2	3	AV
1-19	40 LCC Oak/Oak	652	878	978	836	1555	1473	1498	1509
1-31	50 HCC	1714	1802	1708	1741	2503	3484	3353	3113
1-16	50 LCC	767	1064	983	938	1540	1835	1958	1778
1-1	50 HCB	1355	1167	1124	1215	1788	1600	1550	1646
1-15	50 LCB	1228	1506	1136	1290	2238	2048	1880	2055
* $SP.G_B/Sp.G_F$ = Specific Gravity of Blocking Material/Specific Gravity of Floor Material. Specific Gravity of Various Species of Wood are Listed Below:									
<u>Wood</u>		<u>Specific Gravity</u>							
Oak		0.63							
Southern Pine		0.55							
Douglas Fir		0.50							
Western Hemlock		0.45							
Engleman Spruce		0.35							

factor whereas he may not be comfortable using an oak/oak joint like Test 1-1 without a safety factor.

H. It is also interesting to note on Figure 7 that the yield point is located near 0.1 inch of permanent displacement. Or in other words, a joint can be considered a failure when the joint members are displaced 1/8 inch (this is not a momentarily displacement due to a dynamic force).

I. No tests were conducted to determine the effects of improperly pre-drilled holes for large nails. Also no efforts were made to measure the effect of wood grain orientation with respect to the nail, i.e., wood grains are perpendicular, or parallel, or at an angle to the nails.

LEGEND
TEST 1-8, RUN 1
TEST 1-8B, RUN 1
TEST 1-1, RUN 2
TEST 1-10, RUN 2

PERMANENT DISPLACEMENT, INCH

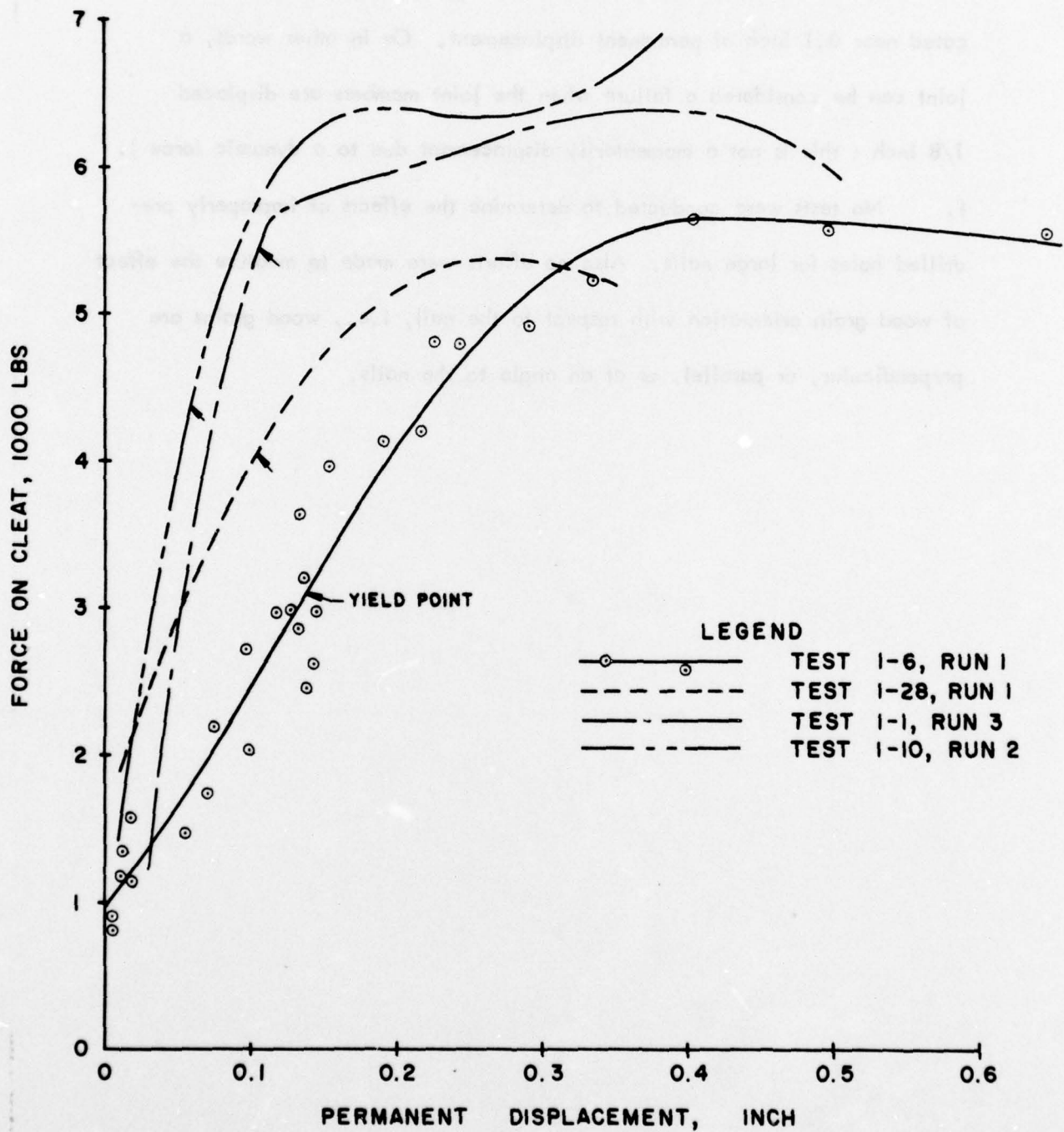


FIGURE 7. COMPARISON OF STRENGTH CHARACTERISTIC FOR SEVERAL TESTS.

APPENDIX I

		REVISIONS		
		LTR	DESCRIPTION	DATE
APPLICATION				

MTMC DATA CONVERSION AND REDUCTION PROGRAM

		DARCOM AMMUNITION CENTER DATA ANALYSIS		
		MTMC DATA CONVERSION AND REDUCTION PROGRAM		
		A	28620	1000002
		SCALE N/A	DATE 12-15-75	SHEET 1

* 1000002 MTMCSP MTMC DATA REDUCTION PROGRAM

TITL MTMS DATA REDUCTION PROGRAM

DATRED DSEC

DATA DATREP:X'8000'0:0:0:0:0
DATA DATRED:DATREP:DF:GRUB
DATA X'8000'DATREP:0:0:0:0:0

DT DATA DATRED:0:0:0

DF DATA X'0041'

IN DATA DATRED:BUF:0:0:X'441'

MTD DATA DATRED:BUF:128:128:X'0042'

MTOL DATA DATRED:0:10710:10710:X'0042'

DFD DATA DATRED:BUF:128:128:X'0043'

BUF RES 64

BUF1 RES 64

IKNT DATA 0

IMAX DATA 0

IMIN DATA 0

ISUM DATA 0

DATA 0

ISTD DATA 0

ILIM DATA 0:0

ILPSW DATA 0

I DATA 0

IST DATA 0

J DATA 0

JJ DATA 0

IEND DATA 0

RSUM DATA 0

IXA DATA 0

IYA DATA 0

IXX2 DATA 0

IYY2 DATA 0

LFCR EQU X'000A'

DATA L2-L1-1X2

L1 DATA LFCR:C'ENTER TEST RUN NUMBER'

DATA LFCR:C'XXXXXXXXXX'LFCR

DATA L3-L2-1X2

L2 DATA LFCR:C'IS NUMBER RIGHT?'

DATA L4-L3-1X2

L3 DATA LFCR:C'IS ANALOG TAPE READY?'

DATA L5-L4-1X2

L4 DATA LFCR:C'NO PEAK IN CHANNEL 1'

DATA 2

L5 DATA LFCR

END

DATREP PSEC

R0 EQU X'88'

R1 EQU X'89'

R2 EQU X'8A'

LA 0:0

* INPUT TEST RUN NUMBER

ST 0:0000:1

BL 2:DT1

DATA L1

BL 2:IN1

DATA BUF:10

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 02

* IS NUMBER CORRECT NO START OVER

* YES CONTINUE

BL 2:DT1

DATA L2

BL 2:IN1

DATA 3:3:2

DDDD LA 0:0

CRA 0:C*NN

BC 11:DATREP

* IS ANALOG TAPE READY NO WAIT

* YES CONTINUE

DT1 BL 2:DT1

DATA L3

BL 2:IN1

DATA 3:3:2

LA 0:0

CRA 0:C*NN

BC 11:DT1

CRUB EQU X'0F30'

LA 4:DATREP

* RESET A/D CONVERTER

SSB RESET

LA 0:0

LDS 3:2

DATA 3:2:X'81C0'

* SEARCH FOR START SIGNAL

SERH1 LDCR C0:00:CTWRD

LDCR C16:00:CMDWRD

SETB 11:1

SETB 11:0

LDCR C16:00:OUTWRD

SETB 12:1

L 0:ISUM

L 1:ISUM+1

DA 0:833

ST 0:DATAB+18:3

ST 1:DATAB+24:3

SETB 13:0

CML OUTWRD+14:LIM

NOP

B 3:4

B 3:6

LA 0:0

B SERH1

AA 0:1

CRA 0:10

BC 11:CVTSTR

B SERH1

CTWRD DATA X'25'

CMDWRD DATA X'0500'

OUTWRD DATA 0:0

LIM DATA 625:875

* WHEN START SIGNAL FOUND SEQUENTIALLY

* CONVERT AND STORE DATA

CVTSTR LDCR C0:00:CTWRD

LDCR C16:00:CMDWRD

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 03


```

SETB 11:1
SETB 11:0
LA 1:0
LA 3:0
LA 4:0
CVTST2 LA 0:16
CVTST3 LDCR (16:00:R0
SETB 12:1
SETB 12:0
BBNE 13:1:8
LDCR (16:00:R1
SETB 8:1
STCR (16:00:R2
SETB 13:1
SETB 13:0
SETB 8:0
ST 2:DATAB:3
AA 3:1
CRA 3:24000
BC 11:CVTST1
AA 0:16
CRA 0:112
BC 11:CVTST2
B CVTST3
CVTST1 LA 4:DATRED
LDS 9:2
DATA 9:2:X'8000'
B SCALE
RESET DATA 0:0:9:1
LDS 9:3
ZERO DATA 0
DATA 9:2:X'8100'
LDCR (0:00:ZERO
LDCR (16:00:ZERO
SETB 9:1
SETB 9:0
LDS RESET
* SCALE DATA IN MEMORY
SCALE LA 0:23999
MLA 1:DATAB:0
ARB -1:9-2:0
* SEARCH DATA 1 FOR PEAK
L 3:ZERO
ST 3:IKNT
ST 3:1
B 9:6
SERLOP L 3:1
AA 3:6
ST 3:1
CRA 3:24000
BC 10:B210
L 0:DATAB:3
SA 0:100
BC 10:9:4
B B200
L 0:DATAB:3

```

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 04

```

      SA 0:1000
      BC 12:B202
B200  L  3:ZERO
      ST 3:IKNT
      B  SERLOP
B202  L  3:IKNT
      AA 3:1
      ST 3:IKNT
      SA 3:10
      BC 10:B204
      B  SERLOP

```

* CALCULATE START AND STOP INDEX
 * OF DATA FIELD

```

B204  L  0:1
      SA 0:40*6
      ST 0:1ST
      AA 0:44*6
      ST 0:END
      B  B211

```

```

B210  BL 2:DT1
      DATA L4
      B  DATREP

```

```

B211  B  B300

```

* QUERY I/O DRIVERS

```

DT1   L  3:2:2
      BC 11:3:2
      ST 3:DT+1
      L  3:-1:3
      ST 3:DT+3
      LA 3:DT
      SXBS *127
      B  3:2

```

```

INI   L  3:2:2
      BC 11:4:2
      ST 3:IN+1
      L  3:3:2
      ST 3:IN+2
      LA 3:IN
      SXBS *127
      B  4:2

```

* CALCULATE THE ZERO REFERENCE FOR EACH
 * DATA CHANNEL USING A STANDARD DEVIATION
 * OF 2 FOR DROPPING ERRORS AND THEN
 * RECALCULATE THE AVERAGE
 * STORE THE RESULTS

```

B300  L  3:ZERO
      B  3:6

```

```

B153  L  3:J
      AA 3:1
      ST 3:J
      CRA 3:5
      BC 10:B154
      L  0:ZERO
      ST 0:IKNT
      L  3:ZERO
      B  3:6

```

MTMC DATA CONVERSION
 AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 05

B151 L 3:I
 AA 3:6
 ST 3:I
 CRA 3:174
 BC 10:B152
 A 3:IST
 A 3:J
 L 0:IKNT
 A 0:DATAB:3
 ST 0:IKNT
 B B151
 B152 L 0:IKNT
 MA 0:1
 DA 0:30
 L 3:J
 ST 1:DATAB:3
 L 0:ZERO
 ST 0:ISUM
 ST 0:ISUM*1
 ST 0:ISTD
 ST 0:IKNT
 L 3:ZERO
 B 3:6
 B180 L 3:I
 AA 3:6
 ST 3:I
 CRA 3:174
 BC 10:B181
 A 3:IST
 A 3:J
 L 1:J
 L 0:DATAB:3
 S 0:DATAB:1
 ST 0:3
 MA 0:0
 DAD 0:ISUM
 ST 0:ISUM
 ST 1:ISUM*1
 B B180
 B181 DA 0:29
 LA 0:0
 LA 3:X'1000'
 SXBS *127
 MA 0:2
 ST 1:ISTD
 L 3:J
 L 1:DATAB:3
 A 1:ISTD
 ST 1:ILIM
 L 1:DATAB:3
 S 1:ISTD
 ST 1:ILIM*1
 CR 1:ILIM
 BC 10:B187
 L 0:ILIM
 ST 0:ILIM*1

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 06


```

B187 ST 1:ILIM
L 0:ZERO
ST 0:ISUM
ST 0:ISUM+1
ST 0:IKNT
L 3:ZERO
B 9:6
B182 L 3:1
AA 3:6
ST 3:1
CRA 3:174
BC 10:B184
A 3:1ST
A 3:J
L 0:DATAB:3
CR 0:ILIM
BC 12:B182
CR 0:ILIM+1
BC 10:B182
AMI IKNT:1
L 0:DATAB:3
A 0:ISUM
ST 0:ISUM
B B182
B184 L 0:IKNT
ST 0:B185+1
L 0:ISUM
MA 0:1
B185 DA 0:0
L 3:J
ST 1:DATAB:3
B B153
* PRINT ZERO REFERENCE VALUES
B154 BL 7:PRNT
DATA DATAB
B B158
PRNT L 3:2:7
ST 3:B159+1
BL 2:JT1
DATA L5
L 3:ZERO
B 9:6
B156 L 3:1
AA 3:1
ST 3:1
CRA 3:5
BC 10:3:7
B159 L 0:0:3
LA 3:X'2800'-#BUF1+1
SXBS *127
LA 3:C' '
ST 3:BUF1+4
LA 3:8
ST 3:BUF1
BL 2:JT1
DATA BUF1+1

```

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 01

B B156
 * LOCATE MAXIMUM AND MINIMUM VALUES
 * FOR EACH CHANNEL

B158 L 3:ZERO

B B 8:6
 B165 L 3:J

AA 3:1

ST 3:J

CRA 3:5

BC 10:B166

L 0:ZERO

ST 0:IMAX

ST 0:IMIN

ST 0:ISUM

ST 0:ISUM*1

ST 0:RSUM

L 3:IST

AA 3:180

B B 8:6
 B163 L 3:I

AA 3:6

ST 3:I

CR 3:IEND

BC 10:B164

A 3:J

L 0:DATAB:3

BC 12:B161

CR 0:IMAX

BC 12:B162

ST 0:IMAX

B B162
 B161 CR 0:IMIN

BC 10:B162

ST 0:IMIN

* CALCULATE AREA UNDER EACH CURVE

B162 L 3:J

S 0:DATAB:3

MA 0:10

DAD 0:ISUM

ST 0:ISUM

ST 1:ISUM*1

B B163
 B164 L 3:J

L 0:IMAX

S 0:DATAB:3

ST 0:DATAB*6:3

L 0:IMIN

S 0:DATAB:3

ST 0:DATAB*12:3

L 0:ISUM

L 1:ISUM*1

DA 0:833

ST 0:DATAB*18:3

ST 1:DATAB*24:3

B B165
 * PRINT MINIMUM VALUE

MTMC DATA CONVERSION
 AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 08

```

B166  BL 7:PRINT
      DATA DATAB*6
* PRINT MAXIMUM VALUE
      BL 7:PRINT
      DATA DATAB*12
* PRINT WORK REMAINDER
      BL 7:PRINT
      DATA DATAB*18
* PRINT WORK
      BL 7:PRINT
      DATA DATAB*24
* CALCULATE FINAL VALUE OF CHANNEL 6
* BASED ON TWO STD. DEVIATIONS
      L 0:DATAB*29
      M 0:DATAB*25
      DA 0-4
      ST 0:DATAB*30
      ST 1:DATAB*31
      L 1:END
      AA 1-1
      ST 1:END
      LA 2:9
      LA 0:0
      A 0:DATAB*1
      AA 1-6
      ARB -1:8-4:2
      MA 0:1
      DA 0:10
      ST 0:DATAB*32
      ST 1:DATAB*33
      LA 0:0
      ST 0:ISUM
      ST 0:ISUM*1
      L 3:END
      LA 2:9
B240  L 0:DATAB*3
      S 0:DATAB*33
      ST 0:8*3
      MA 0:0
      DAD 0:ISUM
      ST 0:ISUM
      ST 1:ISUM*1
      AA 3-6
      ARB -1:B240:2
      DA 0:9
      LA 0:0
      LA 3:X*1000'
      SXBS *127
      MA 0:2
      ST 1:ISTD
      L 0:DATAB*33
      A 0:ISTD
      ST 0:ILIM
      L 0:DATAB*33
      S 0:ISTD
      ST 0:ILIM*1

```

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 09


```

CR 0:ILIM
BC 10:B241
L 1:ILIM
ST 1:ILIM*1
ST 0:ILIM
B241 LA 0:0
ST 0:ISUM
ST 0:ISUM*1
ST 0:IKNT
L 3:END
LA 2:9
B243 L 0:DATAB*3
CR 0:ILIM
BC 12:B242
CR 0:ILIM*1
BC 10:B242
AMI IKNT*1
L 0:DATAB*3
A 0:ISUM
ST 0:ISUM
B242 AA 3:6
ARB -1:B243*2
L 0:IKNT
ST 0:B245*1
L 0:ISUM
MA 0:1
B245 DA 0:0
ST 0:DATAB*32
ST 1:DATAB*33
* OUTPUT CHANNEL 6 RESULTS
BL 7:PRNT
DATA DATAB*30
B B235
* PROGRAM EXIT
B227 LA 3:X*0400'
SXBS *127
* PRINT DATA SUBROUTINE
PRNT1 L 3:2:7
ST 3:B175*1
BL 2:JT1
DATA L5
L 3:ZERO
B 9:6
B176 L 3:1
AA 3:6
ST 3:1
CRA 3:60
BC 10:3:7
B175 L 0:0:3
LA 3:X*2800'+*BUF1*1
SXBS *127
LA 3:C' '
ST 3:BUF1*4
LA 3:8
ST 3:BUF1
BL 2:JT1

```

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 10

```

DATA BUF1*1
B      B176
* FORMAT TEST DATA TO BINARY DATA
B235  LA  0:X'2020'
      LA  163
      ST  0:BUF1*1
      ARB -1:8-2*1
      L   0:BUF
      ST  0:BUF1*2
      L   0:BUF*1
      ST  0:BUF1*5
      L   0:BUF*2
      MRA 8:X'88'
      DR  0:BUF1*8
      ST  0:BUF1*8
      L   0:BUF*2
      MLA 8:X'88'
      L   1:BUF*3
      MRA 8:X'89'
      DR  0:X'89'
      ST  0:BUF1*11
      L   0:BUF*3
      NA  0:X'F'
      DR  0:BUF1*14
      ST  0:BUF1*14
      L   0:BUF*4
      ST  0:BUF1*17
      LA  0:62
      LA  1:0
      ST  1:BUF*1:0
      ARB -1:8-2*0
      LA  0:X'1700'
      ST  0:BUF
      LA  1:5
      LA  2:0
      LA  3:X'2000'*BUF1
B190  ST  3:8*5
      SXBS *127
      LA  3:0
      RA  3:3
      ST  0:BUF*1:2
      RA  2:1
      ARB -1:B190:1
      LA  3:X'4000'*BUF*7
      SXBS *127
      LA  0:0
      ST  0:BUF*12
      LA  0:32
      L   1:DATA8:0
      ST  1:BUF*13:0
      ARB -1:8-4:0
* OUTPUT LIBRARY RECORD
      LA  3:0FD
      SXBS *127
* OUTPUT LIBRARY RECORD TO MAG TAPE
      LA  3:MTD

```

MTMC DATA CONVERSION
AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 11

SXBS *127
 L 3:IST
 RA 3:DATAB
 ST 3:MTDI+1
 * OUTPUT DATA TO MAG TAPE
 LA 3:MTDI
 SXBS *127
 B B227
 DXX DATA 0
 IYY DATA 0
 RES 40
 DATAB RES 24000
 END

MTMC DATA CONVERSION
 AND REDUCTION PROGRAM

A

28620

1000002

SCALE N/A

DATE 12-15-75

SHEET 12

APPENDIX II

C 1000012 LISTSOS A PROGRAM FOR LEAST
 SQUARE CURVE FITTING
 CDATE 1975

```

C      A PROGRAM FOR LEAST SQUARE CURVE FITTING
      DIMENSION X(200),Y(200),A(11,11),B(11),C(11),P(20)
      WRITE(2,20)
2      FORMAT('ENTER DEGREE OF POLYNOMIAL,XX,MAX IS 10')
      READ(2,4)M
4      FORMAT(I2)
C
      WRITE(2,6)
6      FORMAT('ENTER VALUES OF X AND Y, XX,XXYY,YY, WHEN
1 FINISHED, TYPE 00.0000.00')
      DO 20 I=1,201
      READ(2,10)X(I),Y(I)
10     FORMAT(2F5.2)
      IF (X(I)+20,30+20)
20     CONTINUE
      CALL EXIT
C
30     NUM=I-1
      MX2=M**2
      DO 40 I=1,MX2
      P(I)=0.0
      DO 40 J=1,NUM
      P(I)=P(I)+X(I)**J
40     CONTINUE
C
      N=M+1
      DO 70 I=1,N
      DO 70 J=1,N
      K=I+J-2
      IF (K+60,60+50)
50     A(I,J)=P(K)
      GO TO 70
      A(1,1)=NUM
70     CONTINUE
C
      B(1)=0.0
      DO 80 J=1,NUM
      B(1)=B(1)+Y(J)
80     CONTINUE
      DO 90 I=2,N
      B(I)=0.0
      DO 90 J=1,NUM
      B(I)=B(I)+Y(J)*X(J)**(I-1)
90     CONTINUE
C

```

A PROGRAM FOR LEAST
 SQUARE CURVE FITTING

A

28620

1000012

SCALE N/A

DATE 1975

SHEET 02


```

      IP1=I-1
      DO 300 K=1,NM1
      KP1=K+1
      L=K
      DO 400 I=KP1,N
      IF (ABS(A(I,K))-ABS(A(L,K)))400,400,401
401  L=I
400  CONTINUE
      IF (L-K)500,500,405
405  DO 410 J=K,N
      TEMP=A(K,J)
      A(K,J)=A(L,J)
      A(L,J)=TEMP
410  CONTINUE
      TEMP=B(K)
      B(K)=B(L)
      B(L)=TEMP
C
500  DO 300 I=KP1,N
      FAC=A(I,K)/A(K,K)
      A(I,K)=0.0
      DO 301 J=KP1,N
      A(I,J)=A(I,J)-FAC*A(K,J)
301  CONTINUE
      B(I)=B(I)-FAC*B(K)
300  CONTINUE
      C(N)=B(N)/A(N,N)
      I=NM1
710  IP1=I+1
      SUM=0.0
      DO 700 J=IP1,N
      SUM=SUM+A(I,J)*C(J)
700  CONTINUE
      C(I)=(B(I)-SUM)/A(I,I)
      I=I-1
      IF (I)800,800,710
800  DO 900 I=1,N
      WRITE(2,901)I,C(I)
900  CONTINUE
901  FORMAT (I5,E15.7)
C
      WRITE(2,920)
920  FORMAT (CENTER VALUES FOR PLOTTING LEAST SQUARES
1 CURVE, XX.XX, WHEN FINISHED TYPE 00.00)
940  READ(2,950)XT
950  FORMAT (F5.2)
      IF (XT)960,1100,960
960  CONTINUE
      YT=0.0
      YT=YT+C(I)
      DO 1000 I=2,N
      YT=YT+C(I)*XT*(I-1)
1000 CONTINUE
      WRITE(2,1050)XT,YT
1050 FORMAT (2F12.3)
      GO TO 940
1100 CONTINUE
      END

```

A PROGRAM FOR LEAST
SQUARE CURVE FITTING

A

28620

1000012

SCALE N/A

DATE 1975

SHEET 03

APPENDIX III

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT %	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
1-4	Same as 1-23											
1-5	Same as 1-25											
1-6	1	13	18.5	2593	4580	3.74	1079	3138	3.74	4.03	0.133	0.336
Oak on WH					6290	6.99	"	5660	5.25	6.85	0.401	0.720
50d HCB												
1-6	2	13	18.5	2593	4940	5.67	1079	3523	3.94	4.73	0.115	0.318
					6870	8.82	"	6010	5.50	6.75	0.396	0.840
	3	13	18.5	2593	3870	4.96	1079	2665	3.27	3.28	0.103	0.242
					6560	8.74	"	5550	5.18	7.16	0.369	0.766
1-7	1	7	12	2593	3680	3.56	1079	2733	3.19	3.85	0.078	0.220
Oak on ES				"	5500	6.26	"	4560	4.31	4.76	0.397	0.608
50d HCB	2	7	12	2593	3900	5.42	1079	2583	2.90	3.26	0.098	0.230
				"	5160	6.52	"	4120	4.05	5.00	0.414	0.578
	3	7	12	2593	3840	3.94	1079	2923	3.42	5.99	0.063	0.224
					5360	7.85	"	4750	4.56	-	0.353	0.614
1-8	1	16	17	2593	6040	6.30	1079	3536	4.82	6.05	0.048	0.202
DF on Oak					8110	10.01	"	6950	6.77	9.13	0.392	0.746
50d HCB	2	17.5	17	2593	5970	6.32	1079	5095	5.14	5.54	0.063	0.236
					8700	-	"	7590	7.12	7.43	0.349	0.714
	3	17.5	17	2593	5650	5.58	1079	4060	4.53	6.03	0.056	0.202
					7580	8.41	"	6580	6.44	7.05	0.382	0.782
1-9	1	11	12	2014	7940	7.01	500	4140	8.44	4.42	0.229	0.514
DF(1) on Oak												
50d HCB	2	11.5	12	2593	7480	7.52	1079	5580	5.42	4.23	0.285	0.734
				2014	8040	6.94	500	4283	7.55	5.20	0.359	0.600

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT %		DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
		CLEAT	FLOOR									
		11	11.5	2349	7940	7.82	835	5640	7.10	4.01	0.240	0.632
	3	11	12.	2014	7520	6.53	500	4205	7.72	3.83	0.087	0.290
		11	11.5	2349	7640	7.99	835	5590	7.25	4.44	0.484	0.842
1-10	1	19	17	2593	6090	6.51	1079	4348	5.04	6.53	0.053	0.262
WH on Oak				"	7890	9.17	"	6870	6.65	7.17	0.348	0.800
50d HCB	2	19	17	2593	5840	5.75	1079	4377	5.16	Bad data	0.041	0.234
				"	8450	8.90	"	6870	6.87	-	0.381	0.876
	3	19	17	2593	5310	5.68	1079	4633	4.84	8.21	0.036	0.280
				"	7830	8.07	"	6600	6.42	8.04	0.424	0.850
1-11	1	17.5	17	2593	6100	5.77	1079	4670	5.11	5.80	0.090	0.322
WH(1) on Oak				"	7920	9.37	"	6920	6.54	8.14	0.421	0.806
50d HCB	2	17.5	17	2593	5910	5.15	1079	4730	5.29	7.06	0.086	0.332
				"	8030	10.72	"	7430	7.41	10.41	0.469	0.888
	3	17.5	17	2593	6240	6.06	1079	4897	5.77	9.89	0.078	0.306
				"	8110	10.52	"	7320	7.40	-	0.398	0.782
1-12	1	12	11.5	2593	6720	5.77	1079	5098	5.64	6.08	0.087	0.280
ES on Oak					8490	7.89	"	7720	7.76	10.38	0.315	0.710
50d HCB	2	12	11.5	2593	5340	5.11	1079	4382	5.07	5.23	0.056	0.272
				"	6980	7.39	"	6060	6.36	6.68	0.339	0.700
	3	12	11.5	2593	6230	6.14	1079	5360	5.89	6.97	0.051	0.284
				"	7680	7.05	"	7120	7.01	8.16	0.198	0.544
1-13	1	12	11.5	2593	4980	4.09	1079	4386	4.93	4.01	0.046	0.274
ES(1) on Oak				"	7170	7.85	"	6280	6.31	7.45	0.255	0.638

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT %		DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
50d HCB	2	12	11.5	2593	6080	6.28	1079	4600	5.32	8.12	0.086	0.334
				"	8350	8.67	"	7120	7.33	10.33	0.336	0.768
	3	12	11.5	2593	4890	5.19	1079	4398	4.83	5.94	0.069	0.296
				"	7680	7.25	"	6990	7.09	7.10	0.440	0.796
1-14	1	11	11.5	2349	6690	5.84	835	4927	5.96	5.18	0.099	0.286
SP on Oak				"	9150	8.63	"	6390	8.27	-	0.528	0.792
50d HCB	2	10	11.5	2349	6030	6.12	835	4525	5.64	2.42	0.080	0.298
				"	7800	8.87	"	6150	7.70	4.54	0.235	0.616
	3	12	11.5	2349	6950	6.72	835	5056	6.70	7.03	0.081	0.280
				"	8710	7.45	"	6380	7.88	8.78	0.166	0.460
1-15	1	18	13	2593	5720	4.55	1079	4913	4.84	5.66	0.123	0.262
Oak on Oak				"	9050	7.88	"	8950	8.40	-	0.566	0.786
50d LCB	2	18	13	2593	7550	5.98	1079	6024	5.61	7.32	0.147	0.304
				"	8420	8.70	"	8190	7.01	-	0.378	0.586
	3	18	13	2715	5350	5.10	1201	4545	4.42	5.66	0.092	0.242
				"	8210	7.38	"	7520	6.77	-	0.723	0.934
1-16	1	18	13	2715	4500	4.30	1201	3510	3.65	5.79	0.052	0.140
Oak on Oak				"	7050	7.89	"	6150	5.40	7.99	0.488	0.646
50d LCC	2	18	13	2715	4420	4.40	1201	3068	3.08	3.94	0.044	0.124
				"	7380	6.54	"	6720	5.88	-	0.605	0.802
	3	18	13	2715	4400	4.63	1201	3298	3.43	5.33	0.058	0.160
				"	6970	6.45	"	6210	5.86	-	0.571	0.752
1-17	1	11	8.5	2959	7190	4.51	1445	4677	3.84	4.10	0.088	0.262
Oak on Oak				"	9600	3.77	"	8120	6.53	5.83	0.550	0.842

TEST NUMBER	2	3	4		5	6	7	8	9	10	11	12	13
			MOISTURE CONTENT %										
	RUN NO.	CLEAT	FLOOR		DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
40d HCC	2	11	8.5		2959	7900	-	1445	5688	5.20	1.64	0.078	0.280
4 Nails					"	9740	-	"	7710	6.50	2.45	0.414	0.682
	3	11	8.5		2959	7200	5.49	1445	4897	3.45	4.03	0.109	0.338
					"	9660	3.33	"	7800	5.40	6.10	0.497	0.818
1-18	1	18	11.5		2349	5400	5.10	835	3898	5.27	1.21	0.083	0.274
Oak on Oak					"	7230	6.65	"	5220	6.55	3.55	0.306	0.586
40d HCB	2	18	11.5		2349	4620	4.78	835	3307	4.41	0.99	0.124	0.280
					"	6500	6.78	"	4460	5.66	1.66	0.391	0.582
	3	18	11.5		2349	5150	4.96	835	3411	4.56	1.70	0.167	0.354
					"	5960	6.78	"	4450	5.61	1.85	0.293	0.534
	4	18	16		2349	5290	4.90	835	4278	5.17	1.94	0.098	0.294
					"	6260	6.31	"	5260	5.95	1.70	0.207	0.450
1-19	1	18	16		2349	4390	4.74	835	2609	3.78	1.49	0.052	0.138
Oak on Oak					"	8340	7.39	"	6220	7.68	2.28	0.550	0.790
40d LCC	2	18	16		2349	4830	4.70	835	3510	4.38	1.38	0.073	0.204
					"	7800	6.83	"	5890	6.80	3.07	0.441	0.650
	3	14	16		2349	5870	4.84	835	3912	4.98	4.26	0.088	0.226
					"	7910	7.54	835	5990	7.00	4.24	0.406	0.604
					2349	5230	5.00	835	3380	4.80	4.83	0.084	0.216
1-20	1	18	16		"	7690	7.03	"	5720	7.05	7.48	0.393	0.586
Oak on Oak					2349	4730	4.81	835	3253	4.09	1.24	0.091	0.218
40d LCB	2	18	16		"	6230	6.37	"	4870	5.68	2.01	0.322	0.480
					2349	5160	4.12	835	3377	4.44	1.79	0.059	0.186
	3	18	16		"	7430	6.30	"	5510	6.58	2.15	0.364	0.586

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST	RUN	MOISTURE CONTENT %		DOLLY	DOLLY	DOLLY	HAMMER	HAMMER	HAMMER	SPECIMEN	PERM.	TOTAL
NUMBER	NO.	CLEAT	FLOOR	WEIGHT	IMPACT	ACC.	WEIGHT	IMPACT	ACC.	ACC.	DISPL.	DISPL.
				LBS	FORCE	G'S	LBS	FORCE	G'S	G'S	IN.	IN.
1-21	1	11	11.5	2959	8110	5.71	1445	5830	5.53	4.59	0.091	0.298
Oak on Oak Floor grain parallel to nails												
30d HCC	2	11	11.5	2959	7810	5.73	1445	5560	5.72	4.62	0.096	0.330
				"	9570	3.42	"	7920	7.34	5.65	0.360	0.756
1-21	3	12	11	2959	7540	5.56	1445	4832	4.88	2.82	0.061	0.242
Nails close (= 1 inch) to previous nail hole												
1-22	1			2349	9880	2.87	"	8040	5.99	3.90	0.380	0.694
Oak on Oak				"	3950	3.61	835	2486	3.38	1.16	0.062	0.164
30d LCC	2			2349	5200	4.37	"	3350	4.27	1.26	0.247	0.382
				"	4730	3.90	835	2602	3.64	1.03	0.045	0.158
				"	5880	5.71	"	3650	4.81	4.60	0.314	0.514
	3			2349	4050	4.10	835	2916	3.91	5.30	0.079	0.206
				"	5080	4.84	"	3860	4.62	7.70	0.283	0.464
1-23	1	18	10	2471	5590	5.24	957	4616	5.49	5.63	0.103	0.318
Oak on DF				"	6960	7.04	"	5640	6.16	8.79	0.282	0.614
50d HCB	2	18	10	2471	5510	5.12	957	4212	4.80	5.30	0.048	0.236
				"	8040	7.77	"	6330	6.64	7.02	0.251	0.802
	3	18	10	2471	4460	4.62	957	3758	3.95	4.78	0.043	0.316
				"	6160	5.90	"	5140	5.35	5.52	0.201	0.590
1-24	1	12	12	2959	6140	5.5	1445	4283	4.31	4.67	0.104	0.320
Oak on DF				"	9060	7.95	"	6100	5.74	5.70	0.316	0.708
50d HCC	2	12	12.5	2959	5750	3.56	1445	3643	3.93	2.47	0.068	0.250
				"	8620	6.87	"	5950	5.64	-	0.238	0.610
	3			2959	6790	4.20	1445	4360	4.28	3.29	0.066	0.320
				"	8250	6.90	"	5510	5.02	6.91	0.193	0.598

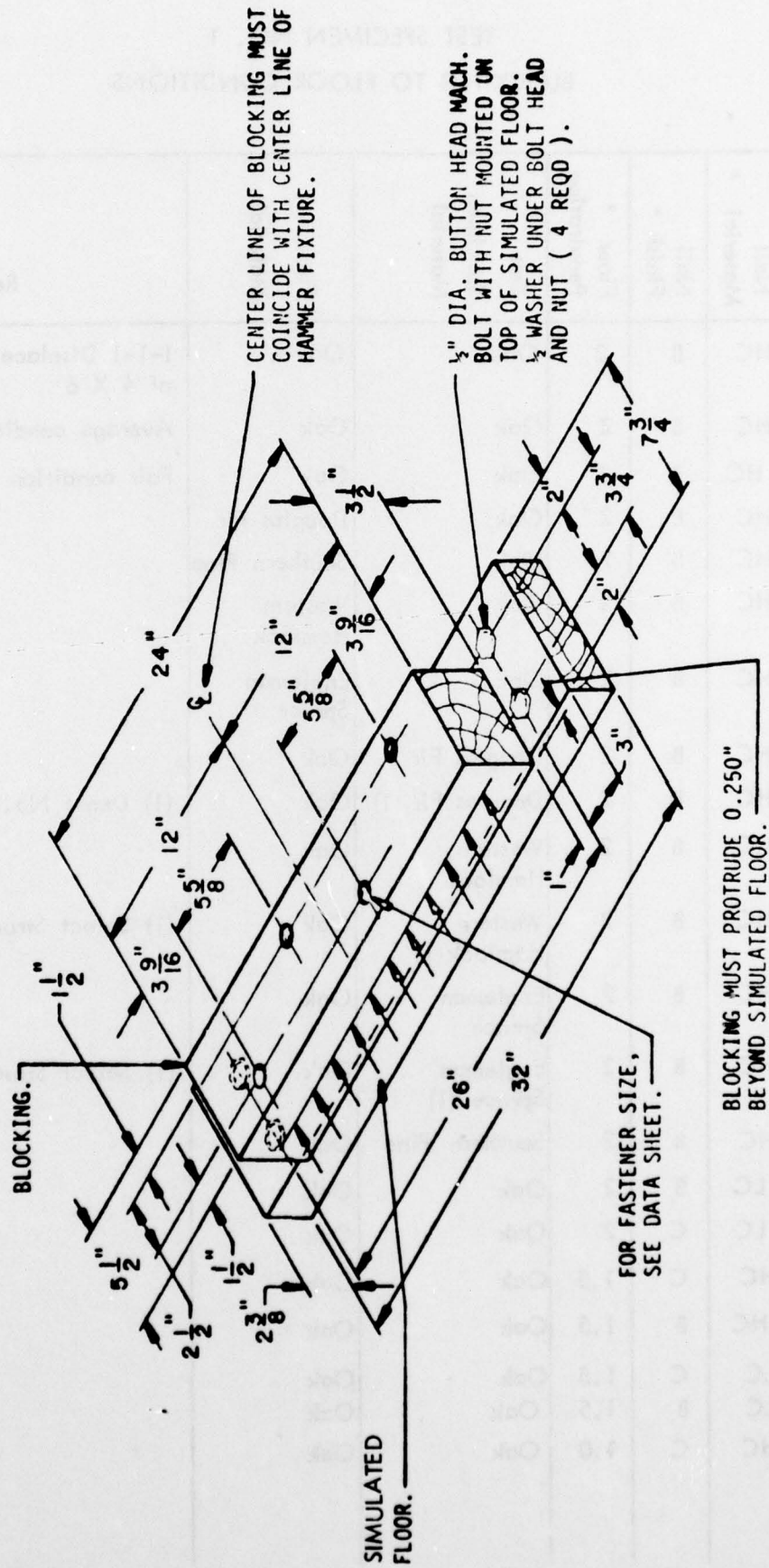
1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CLEAT	CONTENT % FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
1-25	1			2349	6360	5.69	835	4713	5.75	6.25	0.075	0.262
Oak on SP				"	8600	7.58	"	6650	7.84	11.08	0.249	0.602
50d HCB	2	18	10	2471	6480	6.28	957	5820	6.25	7.27	0.077	0.334
					7130	7.45	"	6400	6.65	8.00	0.167	0.508
1-25	3	18	10	2471	5870	5.03	957	4980	5.51	5.69	0.093	0.288
				"	6810	6.33	"	5840	6.44	7.31	0.175	0.494
1-26	1	11.5	11.5	2959	5840	3.46	1445	3933	3.67	-	0.087	0.226
Oak on SP		Used 4 nails		"	9470	6.42	"	6880	6.06	1.32	0.549	0.938
50d HCC	2	13.5	11.0	2959	6730	5.17	1445	4958	4.46	4.84	0.081	0.278
		Used 4 nails		"	9710	7.78	"	6780	6.47	6.82	0.440	0.802
	3	13.5	11.0	2959	6550	4.26	1445	4523	4.65	4.96	0.044	0.264
		Used 4 nails		"	9790	9.03	"	6630	5.94	5.27	0.529	0.856
1-27	Same as 6											
1-28	1	11.5	12	2959	5700	3.73	1445	4003	3.88	3.31	0.089	0.326
Oak on WH		Used 4 nails		"	7940	5.92	"	5680	5.06	4.76	0.206	0.568
50d HCC	2	11.5	13	2959	5920	3.63	1445	3960	3.87	3.51	0.080	0.318
		Used 4 nails		"	8060	6.31		5600	5.37	4.69	0.239	0.626
	3	11.5	13	2959	6090	5.22	1445	4495	4.08	4.20	0.107	0.338
1-29	Same as 7											
1-30	1	13	10.5	2959	5670	3.94	1445	3295	3.93	3.37	0.163	0.422
Oak on ES		Used 4 nails		"	7640	5.01	"	5350	4.92	4.15	0.437	0.81
50d HCC	2	13	10.5	2959	5070	3.55	1445	3883	3.40	2.31	0.111	0.302
		Used 4 nails			8450	5.92	"	5690	5.29	2.23	0.651	1.08
	3	13	10.5	2959	5770	3.48	1445	2743	3.71	4.79	0.104	0.394

TEST NUMBER	2	3	4		5	6	7	8	9	10	11	12	13
RUN NO.	MOISTURE CONTENT %		DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.		
	CLEAT	FLOOR											
1-31	1	Used 4 nails				8240	6.12		5920	5.55	2.25	0.540	0.924
Oak on Oak		12	7.5	2959	8380	7.36		1445	6854	7.30	5.61	0.073	0.304
		4 nails		"	10160	6.87		"	10010	7.22	3.16	0.462	0.844
50d HCC	2	12	7.5	2959	7700	5.15		1445	5405	5.36	4.32	0.082	0.370
		3 nails		"	9670	4.14		"	7840	6.44	5.74	0.530	0.918
1-31	3	12	7.5	2959	7200	5.97		1445	5123	4.70	-	0.084	0.334
		3 nails	"	"	9770	4.26		"	10060	9.02	-	0.742	1.104
1-16	1	13	7.75	2959	5170	3.98		1445	3068	3.49	3.29	0.066	0.210
		4 nails		"	8510	7.83		"	6160	5.57	-	0.553	0.704
	2	13	7.75	2959	6250	4.69		1445	4258	3.75	1.12	0.078	0.222
		4 + nails		"	9670	6.87		"	7340	6.23	9.46	0.441	0.624
	3	-	7.75	2959	5640	4.36		1445	3933	3.44	1.07	0.062	0.188
				"	10190	7.91		"	7830	5.34	11.37	0.410	0.594
1-32	1	14	9.5		4540	3.20		1445	2918	2.58	2.39	0.045	0.158
					7070	5.15			5230	4.16	4.48	0.443	0.604
	2	14	9.5	2959				1445					
	Cleat 3-7/8" Thick			"	7450	4.46		"	5070	3.42	4.56	0.470	0.618
	3			2959	3980	2.83		1445	2490	2.19	1.95	0.056	0.176
					7240	6.38			6210	4.83	6.89	0.639	0.778
1-33	1	14	11	2959	6410	4.84		1445	4335	2.94	3.94	0.073	0.248
	Cleat 3-3/8" Thick			"	8200	6.73		"	5840	4.20	4.55	0.253	0.530
	2	14	11	2959	6250	4.75		1445	4445	4.30	3.04	0.050	0.226
	Cleat 3-3/8" Thick				8990	6.68		"	6170	5.93	2.61	0.346	0.642
	3	14	11	2959	6520	5.08		1445	4410	4.05	1.82	0.066	0.250
					8610	6.12		"	6020	5.46	2.73	0.289	0.562

APPENDIX IV

TEST SPECIMEN NO.1 **BLOCKING TO FLOOR CONDITIONS**

BLOCKING GRAIN ORIENTATION PARALLEL TO FLOOR GRAIN
HAMMER FORCE APPLIED NORMAL TO BLOCKING GRAIN.



TEST SPECIMEN NO. 1
BLOCKING TO FLOOR CONDITIONS

Test Schedule	Nail Size	Nail Material *	Nail Finish *	Floor * Penetration	Test Specimen Material	Floor Material	Remarks
1	50d	HC	B	2	Oak	Oak	1-1-1 Displacement gage at top of 4 X 6
2	50d	HC	B	2	Oak	Oak	Average condition floor
3	50d	HC	B	2	Oak	Oak	Fair condition floor
4	50d	HC	B	2	Oak	Douglas Fir	
5	50d	HC	B	2	Oak	Southern Pine	
6	50d	HC	B	2	Oak	Western Hemlock	
7	50d	HC	B	2	Oak	Engleman Spruce	
8	50d	HC	B	2	Douglas Fir	Oak	
9	50d	HC	B	2	Douglas Fir (1)	Oak	(1) Dense No. 1
10	50d	HC	B	2	Western Hemlock	Oak	
11	50d	HC	B	2	Western Hemlock (1)	Oak	(1) Select Structural No. 1
12	50d	HC	B	2	Engleman Spruce	Oak	
13	50d	HC	B	2	Engleman Spruce (1)	Oak	(1) Select Structural No. 1
14	50d	HC	B	2	Southern Pine	Oak	
15	50d	LC	B	2	Oak	Oak	
16	50d	LC	C	2	Oak	Oak	
17	40d	HC	C	1.5	Oak	Oak	
18	40d	HC	B	1.5	Oak	Oak	
19	40d	LC	C	1.5	Oak	Oak	
20	40d	LC	B	1.5	Oak	Oak	
21	30d	HC	C	1.0	Oak	Oak	

Test Schedule	Nail Size	* Nail Material	* Nail Finish	* Floor Penetration	Test Specimen Material	Floor Material	Remarks
22	30d	LC	C	1.0	Oak	Oak	
23	50d	HC	B	2	Oak	Douglas Fir	
24	50d	HC	C	2	Oak	Douglas Fir	
25	50d	HC	B	2	Oak	Southern Pine	
26	50d	HC	C	2	Oak	Southern Pine	
27	50d	HC	B	2	Oak	Western Hemlock	
28	50d	HC	C	2	Oak	Western Hemlock	
29	50d	HC	B	2	Oak	Engleman Spruce	
30	50d	HC	C	2	Oak	Engleman Spruce	
31	50d	HC	C	2	Oak	Oak	
32	30d	LC	B	1.0	Oak	Oak	
33	30d	HC	B	1.0	Oak	Oak	
*	HC - High Carbon Nail - AISI 1040 - Tempered, 42 Rockwell C LC - Low Carbon Nail B - Bright C - Coated Floor penetration in inches Additional Nail Characteristics: Flat Head Diamond Point Plain Shank Nailed Vertically into Lumber						

APPENDIX V

APPENDIX 5 -- EQUIPMENT AND INSTRUMENT SPECIFICATIONS.

INSTRUMENT OR EQUIPMENT	MANUFACTURER	MODEL NUMBER	RATED FULL SCALE OUTPUT	SENSITIVITY OR CHANGE IN OUTPUT NO LOAD TO FULL LOAD		LINEARITY	OTHER INFORMATION
1. Shock Absorber	Ace Controls, Inc.	5 AHS (1-1/2 X 6-1/2)					
2. Load Cell (Ch. #1)	Revere Corp of America	Drawing C-43234	100,000 Lb	1.75 \pm .02% MV/V Input	0 to + .15% of full load output	Input impedance at 75°F = 750 \pm 10HMS	
3. Load Cell (Ch #2)	Ammunition Center						
4. Accelerometers (Ch #3)	Consolidated Elec- trodynamics	4-202-0001	\pm 50g, 46.98 MV		\pm 0.53% FR	Ser. No. 15280, input Resist. = 341 OHMS	
(Ch #4)		4-202-0001					
(Ch #5)		4-202-0001	\pm 50g, 43.06 MV		0.19% FR	Ser. No. 16909, input Resist. = 341 OHMS	
5. Position Transducer (Ch #6)	Transducer Controls Corp.	PT-101-20A	20 Inch	47.325 MV/V Input	\pm 0.1% Full	Excitation = 15 Volts AC or DC output resistance = 0-500 OHMS	
6. Power Supply	Consolidated Elec- trodynamics	3-140	Voltage, 24 DC current, 200 MA			Regulation, 0.05% no load to full load 0.03%, with a \pm 10% line change.	
7. Balance Bridge (Univer- sal Signal Conditioning Module)	Consolidated Elec- trodynamics	8-113-2	Control Bridges up to 1000 OHMS			Compensates for a 10% un- balance of full scale output of bridges.	
8. DC Amplifier	Consolidated Elec- trodynamics	1-168	10 to 500 Volts Accuracy = \pm 2% @ DC	Input = 20 MV to 100V Peak, FS (10V) output	\pm 25% of FS	Output = \pm 10 Volts Peak @ 100 Ma	
9. FM Record Amplifier	Consolidated Elec- trodynamics	12-354 B	20 to 27 Ma Peak-to- Peak Square Wave		\pm 0.5% of FS	Input Imped = 10,000 OHMS nominal freq response = DC to 20 KH _z , \pm 0.5db	

INSTRUMENT OR EQUIPMENT	MANUFACTURER	MODEL NUMBER	RATED FULL SCALE OUTPUT	SENSITIVITY OR CHANGE IN OUTPUT NO LOAD TO FULL LOAD		OTHER INFORMATION
				LINEARITY		
10. Magnetic Tape Recorder	Bell & Howell	VR - 3360	1-7/8 to 60 IPS			Accuracy = $\pm 0.25\%$ @ 60 Hz
11. FM Reproduce Amplifier	Consolidated Elec- tronics	12-357A	+ 1.414 V DC (or 1 V RMS) FS output for \pm 40% deviation of carrier center frequency	$\pm 0.5\%$ Terminal	Signal to noise ratio = 55 db Min Harmonic Distortion = 1% Max. Frequency response = Uni- form within 0.6 db	
12. Oscillograph	Consolidated Elec- tronics	5-133	Transport Speeds = 0.1 to 160 IPS Max writing speed = 90,000 IPS			Timing intervals, 0.001 Sec to 10.0 Sec, 10th line accented
13. Magnetic Tape	Ampex	746-57G111	1 in X 3600 Ft	± 1 db ± 1	Sig. to DC Noise - 62 db ± 3 Max input level distortion = 3.5% + 0.3, - No limit Signal transfer - 46 db	
14. Computer	Texas Instruments	960A	Execution Time Load, 3.3 Micro Sec Store, 3.6 " Add, 3.6 "			32 Bit Instruction Word 16 Bit Data Word Internal Storage = Up to 32,768 Words Memory Cycle = 750 Nan - seconds
15. Tape Transport	Texas Instruments	979	Tape Velocity 15 - 45 IPS	Long Term, $\pm 2\%$ Short Term, $\pm 3\%$		Start Time, 10 MS Stop Time, 10 MS Start Distance, 0.190 Inches Stop Distance, 0.220 Inches
16. Electronic Data Terminal	Texas Instruments	Silent 700 733-ASR	Transmit, Receive, Print, Play Back (From Tape), and Record on Tape the ASC11 Code and Character Set at Speeds of 10, 15, or 30 Characters Per Second.			

INSTRUMENT OR EQUIPMENT	MANUFACTURER	MODEL NUMBER	RATED FULL SCALE OUTPUT	SENSITIVITY OR CHANGE IN OUTPUT NO LOAD TO FULL LOAD	LINEARITY	OTHER INFORMATION
17. Magnetic Tape Recorder (Computer Room)	Honeywell	5600 C	15/16 to 60 IPS			Speed Accuracy Within 0.15% of Selected Speed
18. A/D Converter	Texas Instruments	For 960A Computer RTP 7460/20	Input Voltage Ranges, + 4.096, + 5.12, ± 10.24		+ 0.02% of FS	Accuracy, ± 0.05% of Full Scale Channel Rate, up to 20,000 Samples/Sec (includes A/D Conversion Time)
19. Industrial Radiographic X-Ray Apparatus	For Dept of the Army	FSN 6635-179- 4322 & 6635- 179-4321	300 KV at 3.0 Ma			Timer 0 - 5 Minutes, Auto Reset X-Ray Field Coverage = 44°
20. Radiographic Paper and Developer Assembly	Banner Metals, Inc.	FSN 6525-930- 3274				Film Developing Time: 3000 X Film Packet = 10 Sec TLX Film Packet = 45 Sec
21. Moisture Detector Solid State	Delmhorst Instrument	RC - IC	Ranges 5-12%, 12-20 %, 20 - Saturation Point			Accuracy = Within 0.5% on Range
22. Optical Velocity Sensor	MTS Systems Inc.	VS 2000	200 Milliseconds			System Accuracy: 10 Microseconds